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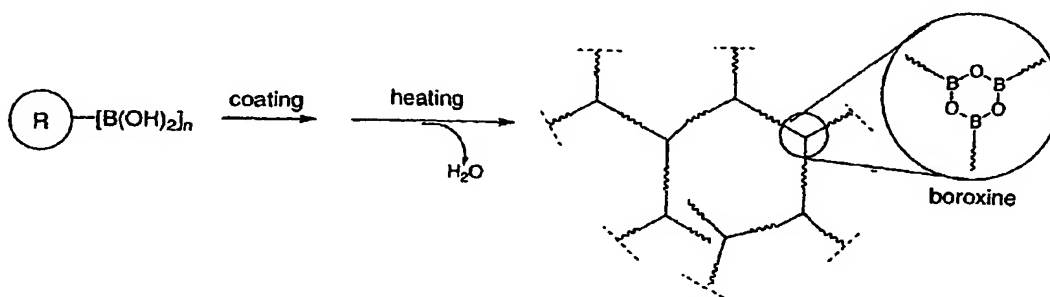
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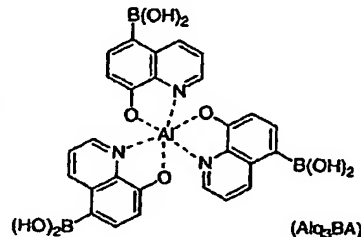
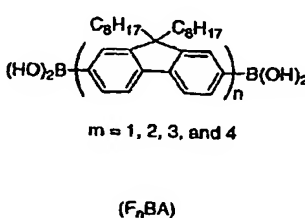
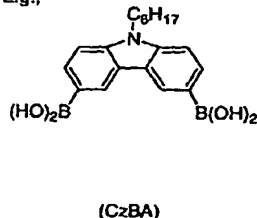
[Continued on next page]

(54) Title: THERMALLY CROSSLINKABLE MATERIALS AND MULTI-LAYERED DEVICES THEREFROM



$n = \text{or} > 1$ ;  
R = organic or organometallic complex moiety including oligomer and polymer.

E.g.,



(57) Abstract: The invention disclosed relates to cross-linkable composites of boronic acid or a boronic acid derivative such as a boronate, and an organic or organo-metallic moiety having a functionality such as hole transporting, electron transporting and light emitting, to cross-linked composites and to methods for making same. Multi-layer materials and optoelectronic devices including such cross-linked composites are also disclosed.



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# INTERNATIONAL SEARCH REPORT

International Application No

PC 03/01696

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C09K11/06 H01L51/30 H05B33/14

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C09K H01L H05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, CHEM ABS Data, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|--|-----------------------|
|------------|--|-----------------------|

|   |   |        |
|---|---|--------|
| X | WO 00/22026 A (KREUDER WILLI ;AXIVA GMBH (DE); BECKER HEINRICH (DE); SPREITZER HU)<br>20 April 2000 (2000-04-20)<br>page 6, line 1 - page 7, line 19<br>page 13<br>page 15<br>claim 7; example M2 | 1,2,10 |
| X | US 2001/015614 A1 (TAGUCHI TOSHIKI)<br>23 August 2001 (2001-08-23)<br>claims 3-5  | 1,2,10 |

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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### ° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance  
 "E" earlier document but published on or after the international filing date  
 "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)  
 "O" document referring to an oral disclosure, use, exhibition or other means  
 "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention  
 "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone  
 "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.  
 "&" document member of the same patent family

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# INTERNATIONAL SEARCH REPORT

International Application No

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages   | Relevant to claim No. |
|------------|--|-----------------------|
| A          | <p>DATABASE CA [Online]<br/>           CHEMICAL ABSTRACTS SERVICE, COLUMBUS,<br/>           OHIO, US;<br/>           CAREY, ROBERT I. ET AL: "Self-Assembled<br/>           Monolayers Containing.omega.-Mercaptoalkyl<br/>           boronic Acids Adsorbed onto Gold Form a<br/>           Highly Cross-Linked, Thermally Stable<br/>           Borate Glass Surface"<br/>           XP002275437<br/>           retrieved from STN<br/>           Database accession no. 121:142536<br/>           abstract<br/>           &amp; LANGMUIR (1994), 10(7), 2228-34,<br/>           -----</p> | 1,2,10                |

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/CA 03/01696

## Box I Observations where certain claims were found unsearchable (Continuation of item 1. of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:  
1, 2, 10

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: [1,2,10]

A crosslinkable composite of boronic acid or boronic acid derivative and an organic moiety having a functionality as light emitting.

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2. claims: [1,2,10]

A crosslinkable composite of boronic acid or boronic acid derivative and an organometallic moiety having a functionality as light emitting.

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3. claims: [1,2,10]

A crosslinkable composite of boronic acid or boronic acid derivative and an organic or organometallic moiety having a functionality as hole or electron transporting.

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4. claims: 3-9

A crosslinked composite network formed by crosslinkable composite of boronic acid or boronic acid derivative and an organic or organometallic moiety having a functionality such as hole transporting, electron transporting and light emitting. Method of making it. Multilayer material comprising a plurality of layers of the crosslinked composite. Multilayer photoelectronic device comprising a layer of a transparent cross linked composite of boronic acid or boronic acid derivative and an organic or organometallic moiety having a functionality such as hole transporting, electron transporting and light emitting. A method of making the multilayer material.

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5. claim: 11

A method of making a crosslinked functional network comprising reacting a compound having a boron atom and a second compound.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PC 03/01696

| Patent document<br>cited in search report |    | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
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